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Office of Intellectual Property & Technology Transfer (OIPTT).
Please complete this form the best you can and return to OIPTT:
310 Lab of Mechanics; Tel: 515-294-4740; FAX: 515-294-0778;
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A. Inventor/Creator(s) : (attach more pages if necessary): Please call OIPTT if you need help in determining inventorship. Intellectual contribution is the most essential criterion.

ISU Inventor/Creator(s): Please designate corresponding inventor with an asterisk (*) behind his/her name. The corresponding inventor should be able to answer questions on both the technology and its commercial utility.

1.
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B. Title of Invention/Creation: A general method to enhance homologous recombination in plants.

Is this related to any previously disclosed invention/creation? NO

C. Reduction to Practice : Have you shown that the invention actually works as intended ? (i.e. have test results to demonstrate, have built a working prototypes, etc.)

Yes, already done: YES

If yes, give date first successfully done: 10/12/1997

Written record in:
Laboratory Notebook of Yongli Xiao, Number 2, Page 61.

D. Brief Description of Invention/Creation

We have developed a means to enhance homologous recombination in plants. We have previously shown that a transposable element in maize can induce recombination between two homologous sequences flanking the transposon insertion site. Now, we have shown that a similar effect occurs in transgenic Arabidopsis: homologous recombination occurs

EXHIBIT D-1

between two copies of a GUS reporter gene when a transposable element is inserted between them. The recombination is observed only when the plants also express a gene encoding a transposase.

These results show that:

1. The Ac/Ds transposable element system induces homologous recombination at a high efficiency.

2. Transposon-induced recombination is a general effect in plants. i.e. it works in both a monocot (maize) and a dicot (Arabidopsis).

3. Transposon-induced recombination works with both a natural homologous substrate (the maize P gene) and with a completely unrelated gene (GUS; a bacterial gene encoding beta-glucuronidase). Thus, transposon-enhanced recombination is a general effect which works with any homologous sequences.

Suggested Keywords: Plant transformation; transgenes; gene targeting; deletions

If we are to file a patent application, we must have your data proving that the new invention actually works (=EBenabling data=ED), and also a detailed description of the materials and methods you used to collect the data. Please send us a copy of the =EBenabling data=ED and your =EBmaterial= s and methods.=ED If you have a manuscript ready for submission describing the invention/creation, please send us a copy.

We will provide two pictures showing evidence of the recombination reaction in maize and Arabidopsis.

E. What do you see as the mostly likely COMMERCIAL use(s) of your invention/creation ? (Update us when you think of new uses.)

Transposon-induced recombination may be applied to several purposes for genetic engineering of plants.

1. Deletion of specific sequences from transgene constructs: Transposon-induced recombination may be useful for efficiently inducing deletions of transgene inserts after they are inserted into the plant chromosome. Such a procedure would provide a means to make specific modifications of a transgene construct after it is integrated into the plant chromosome. For commercial purposes, this method would enable the specific deletion of genes from constructs that have been transformed into plants. For example, one could induce the deletion of genes which are required for selection of transformants, but which are thereafter undesirable to have in the plant.

2. Reducing copy number of multi-copy transgene inserts. Current transformation protocols often result in many copies of the transgene being inserted at a single site, when it is often more advantageous to have a single transgene copy. Transposon-induced homologous recombination could reduce transgene copy number.

EXHIBIT D-2

3. Provide a mechanistic basis for a gene targeting system in plants, i.e. the ability to direct transgene integration to specific sites in the plant genome. Current transformation protocols have a major deficiency: the transforming DNA can integrate at many different sites in the genome, and the local genome environment can profoundly influence the expression of the inserted transgene. Thus, transgenic plants produced by current protocols have a wide range of expression of the introduced transgenes due to position effect. Furthermore, random transgene integration can also disrupt desirable endogenous genes; resulting in the transgene trait being associated with an undesirable new mutant trait. Both of these problems could be circumvented by a gene targeting method. However, gene targeting is currently not feasible in plants because the frequency of homologous recombination is too low. The transposon system described here may increase homologous recombination to sufficient levels to allow efficient gene targeting to occur.

F. Prior Art : (To determine whether we can protect your invention/creation, it will be necessary to compare it to what is already known or available. Please provide the following information to the best of your ability.)

i. What is the deficiency in the prior art which your invention/creation improves upon, or the limitation it extends ? (i.e. It works faster; is cheaper to make; produces less toxic wastes, etc.)

Improves plant transformation by enabling precise modifications to transgenes; may provide a means for gene targeting.

ii. If you can, please provide us copies or references to the prior art (including patents, journal articles, book chapters, news releases, meeting abstracts, names of persons, etc.)

G. What are some other COMPETING invention/creation(s) & how do they compare to yours ?

H. What firms or types of companies do you think may be interested in your invention/creation ? Any companies doing genetic engineering of plants: Monsanto, Pioneer, Dekalb, etc.

I. Conception: date you first got the idea: August 15, 1994.

J. Date & Form of First Written Record: November 16, 1994

Was the written record witnessed ? YES

K. First Public Disclosure : Have you told/written or are you planning to tell/write anybody about the invention/creation? (e.g. abstracts, presentations, proceedings, publications, etc.)

YES

EXHIBIT D-3

If yes, details of the EARLIEST incidence:

Date: 12/11/1997

Event: Biotechnology Conference at Cold Spring Harbor
The Arabidopsis Genome: from Sequence to Function
Cold Spring Harbor Laboratory
Cold Spring Harbor, NY 11724

If possible, please provide a copy of the material you presented or will be presenting.

L. Funding Information: Since by contracts with the University most sponsors have certain intellectual property rights and require notification when an invention or a creation is made, it is important that ALL sources of funding utilized in the conception, creation, or enabling the invention/ creation be reported to this office. You are therefore REQUIRED to disclose ALL relevant funding sources below:

Commodity Groups or Research Consortia : (i.e. USB, NPPC, EPRI, GRI, etc.)

Name of Group: Iowa Corn Promotion Board

M. Signatures/Assignment : All ISU inventor/creator(s) must sign

Signature: Thomas A. Peterson

Date: 10-30-97

Signature: Yongli Xiao

Date: 10/30/97

By the signature(s) above and in accordance to the University policies, the party(ies) hereby assigns to ISURF all intellectual property rights, titles, and interests in this invention/creation.

N. Witnesses : (at least one person not directly involved in the invention/creation)

Signature: Allan G. Atherly

Printed Name: Allan Atherly

Date 10/30/97

INTELLECTUAL PROPERTY DISCLOSURE & RECORD
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EXHIBIT D-4

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